

WHAT IS CLAIMED IS (US) :

1. A switching power source circuit, comprising:
an ON drive circuit for generating an ON drive current which causes a switching element to be turned ON;
an OFF drive circuit for generating an OFF drive current which causes the switching element to be turned OFF;
control means for controlling both the ON drive circuit and OFF drive circuit so as to adjust a duty ratio of the switching element so that an output voltage has a predetermined value; and
OFF drive control means for causing the OFF drive circuit to begin operating at the same time as an OFF period of the switching element begins, and for causing the OFF drive circuit to stop operating before the OFF period of the switching element ends.

2. The switching power source circuit as set forth in claim 1, wherein

the OFF drive circuit includes: a constant current source; a current mirror circuit for generating, as the OFF drive current, a current which is interrelated with a current outputted by the constant current source, so as to supply thus generated current to a control terminal of the

switching element, or so as to draw thus generated current from the control terminal; and stopping means for causing the constant current source to stop outputting the current while the OFF drive control means instructs the OFF drive circuit to stop operating.

3. The switching power source circuit as set forth in claim 1, wherein

the OFF drive circuit includes: a constant current source; a current mirror circuit for outputting a current which is interrelated with a current outputted by the constant current source; current amplifying means for amplifying, as the OFF drive current, the current outputted by the current mirror circuit, so as to supply thus amplified current to a control terminal of the switching element, or so as to draw thus amplified current from the control terminal; and stopping means for causing the constant current source to stop outputting the current while the OFF drive controlling means instructs the OFF drive circuit to stop operating.

4. The switching power source circuit as set forth in claim 1, wherein:

the OFF drive controlling means outputs a duty limit signal for determining an upper limit of the duty ratio of

the switching element to the control circuit, and the duty limit signal is set so that the OFF period of the switching element is longer than an operational period of the OFF drive circuit in a case where the duty ratio has an upper limit value.

5. The switching power source circuit as set forth in claim 4, wherein

the OFF drive controlling means includes:

a reference constant current source for generating a reference constant current;

a constant current generating current mirror circuit for generating a first constant current and a second constant current each of which is interrelated with the reference constant current outputted by the reference constant current source;

first pulse generating means for determining a pulse width of the OFF drive control signal indicative of the operational period of the OFF drive circuit in accordance with the first constant current; and

second pulse generating means for determining a pulse width of the duty limit signal in accordance with the second constant current.

6. The switching power source circuit as set forth in

claim 5, wherein

the first pulse generating means determines the pulse width of the OFF drive control signal in accordance with an amount of the first constant current and capacitance of a first capacitor provided in the first pulse generating means, and the second pulse generating means determines the pulse width of the duty limit signal in accordance with an amount of the second constant current and capacitance of a second capacitor provided in the second pulse generating means.

7. The switching power source circuit as set forth in claim 6, wherein:

an amount of the first constant current and an amount of the second constant current are equal to each other, and

the first and second capacitors that are provided in both the first and second pulse generating means are set to have capacitance values different from each other.

8. The switching power source circuit as set forth in claim 6, wherein:

an amount of the first constant current and an amount of the second constant current are different from each other, and

the first and second capacitors that are provided in both the first and second pulse generating means are set to have capacitance values equal to each other.

9. The switching power source circuit as set forth in claim 6, wherein

the reference constant current source includes: a resistor; current control means for controlling an amount of a current flowing to the resistor so that a both-end voltage of the resistor corresponds to a threshold value of a base-emitter voltage of a transistor; and current outputting means for outputting a current whose amount corresponds to the amount of the current flowing to the resistor as the reference constant current.

10. The switching power source circuit as set forth in claim 5, wherein

the first pulse generating means includes: a first capacitor; and a first signal generating circuit for controlling the OFF drive control signal so that a period from a time when the first pulse generating means begins charging the first capacitor with the first constant current to a time when a both-end voltage of the first capacitor has a predetermined threshold value corresponds to an active period or an inactive period, and the second pulse

generating means includes: a second capacitor; and a second signal generating circuit for controlling the duty limit signal so that a period from a time when the second pulse generating means begins charging the second capacitor with the second constant current to a time when a both-end voltage of the second capacitor has a predetermined threshold value corresponds to an active period or an inactive period.

11. The switching power source circuit as set forth in claim 10, wherein:

an amount of the first constant current and an amount of the second constant current are equal to each other, and

the first and second capacitors that are provided in both the first and second pulse generating means are set to have capacitance values different from each other.

12. The switching power source circuit as set forth in claim 10, wherein:

an amount of the first constant current and an amount of the second constant current are different from each other, and

the first and second capacitors that are provided in both the first and second pulse generating means are set

to have capacitance values equal to each other.

13. The switching power source circuit as set forth in claim 10, wherein

the reference constant current source includes: a resistor; current control means for controlling an amount of a current flowing to the resistor so that a both-end voltage of the resistor corresponds to a threshold value of a base/emitter voltage of a transistor; and current outputting means for outputting a current whose amount corresponds to the amount of the current flowing to the resistor as the reference constant current.

14. An electronic device, comprising a switching power source circuit, wherein

the switching power source circuit includes:

an ON drive circuit for generating an ON drive current which causes a switching element to be turned ON;

an OFF drive circuit for generating an OFF drive current which causes the switching element to be turned OFF;

control means for controlling both the ON drive circuit and OFF drive circuit so as to adjust a duty ratio of the switching element so that an output voltage has a

predetermined value; and

OFF drive control means for causing the OFF drive circuit to begin operating at the same time as an OFF period of the switching element begins, and for causing the OFF drive circuit to stop operating before the OFF period of the switching element ends.